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Original Research Article

Effect of maternal body mass index on pregnancy outcome: a retrospective observational study at a secondary level care hospital in India

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ABSTRACT

Background: Maternal BMI outside the range of 18.5 to 24.9 is associated with adverse maternal and/or foetal outcome. In India, due to extreme socioeconomic distribution, double burden of malnourishment & obesity is being observed, though it varies from state to state. Many studies are conducted showing association of obesity with pregnancy outcome, while importance of underweight is not studied frequently in our geographical area, hence this study was planned to be conducted.

Methods: Our aim was to evaluate the maternal and perinatal outcomes in patients belonging to different BMI categories. We performed retrospective observational study at department of obstetrics and gynaecology, Suri Sadar Hospital, a secondary level care hospital at Birbhum, West Bengal, India between July 2021 to May 2022. Sample size taken was 170. Detailed data were collected from the MCP card (maternal child protection card) of the mothers, antenatal follow up sheets of these women and hospital medical records. The study participants were then divided into 5 groups according to their first trimester BMIs. Statistical analysis was carried out with the help of Micro soft Excel and Epiinfo 7.1 software, $p<0.05$ were considered significant.

Results: Average mean weight gain in our study was 9.1118 kg and we found significant association between weight gain during pregnancy & BMI status ($p<0.001$). We also observed significant association of gestational diabetes mellitus, preeclampsia, caesarean section, pre-term labour, post-partum haemorrhage, post-partum wound infection with obese & overweight mother. FGR and MAS were also found to be significantly associated with maternal BMI. Complex maternal metabolic environment on developing foetus in obese mother alone or complicated by PIH or GDM may be the cause. In underweight mother, malnutrition and micronutrient deficiency may lead to development of FGR.

Conclusions: Pre conceptional normal BMI is essential for every woman willing to conceive. Nutrition-sensitive programs like food security, poverty alleviation, women education, women empowerment, dietary consultation for all newly married couples is required for developing countries to prevent altered pre pregnancy BMI.

Keywords: Maternal BMI, Nutrition, Overweight, Underweight, Pregnancy

INTRODUCTION

Body mass index (BMI) between 18.5 to 24.9 has been defined as normal body weight by world health organization (WHO). Maternal BMI above or below this range is associated with adverse maternal and/or foetal outcome, short term as well as long term, like gestational hypertensive disorder, gestational diabetes, preterm birth, foetal growth restriction, thromboembolism, increase rate of caesarean section etc. Prevalence of maternal obesity

and underweight varies in different countries. Specially obesity in pregnancy is a global concern. In India, due to extreme socioeconomic distribution, double burden of malnourishment & obesity is being observed, though it varies from state to state. The prevalence of overweight women in reproductive age group almost doubled from 12.6% in 2006 to 20.7% in 2016 in India along with co-existence of underweight ladies. The national prevalence of obesity in pregnancy is 12%.[1] Many studies are conducted showing association of obesity with pregnancy outcome, while importance of underweight is not studied frequently in our geographical area, hence this study was planned to be conducted.

Aim and objectives

Aim of the study was to study the effect of maternal body mass index on pregnancy outcomes. Objectives were to evaluate the maternal and perinatal outcomes in patients belonging to different BMI categories admitted in our institution and to determine the maternal risk in terms of ante partum, intrapartum, and postpartum complications in relation to extremes of maternal BMI.

METHODS

We performed retrospective observational study at Department of Obstetrics and Gynaecology, Suri Sadar Hospital, a secondary level care hospital at Birbhum, West Bengal, India between July 2021 to May 2022 after taking approval from Institutional Ethics Committee, Burdwan medical college, Burdwan, West Bengal, India on 7 June 2021.

Sample size

Sample size was calculated using the formula:

$$n = Z2 \times (pq/d2)$$

Where Z^2 =constant 3.84, p=estimated prevalence 12%, q=1-p, d=absolute error 6%. Applying the above formula, the sample size was calculated 113. But considering to loss of follow up and to increase the power of study, final sample size was taken 170. So, we have taken 170 sample size after considering the inclusion and exclusion criteria.

Inclusion criteria

Inclusion criteria were; Pregnant women admitted for delivery, Singleton Pregnancy and Primigravida and multi gravida of more than 18 years of age.

Exclusion criteria

Exclusion criteria were; Any antenatal medical complications other than obesity/underweight, Women with post caesarean pregnancy, Women who cannot be followed up and Women who are not willing to participate in the study.

After taking proper consent, we collected the detailed data from the MCP card (maternal child protection card) of the mothers, antenatal follow up sheets of these women and hospital medical records, which included information on their socio-demographic characteristics, clinical findings & investigation reports, past obstetric and medical histories, obstetric and neonatal outcomes. Gestational age was calculated from the first day of the last menstrual period (LMP) or taken from the dating ultrasound scan that was performed before 20 weeks of pregnancy. The study participants were then divided into 5 groups according to their first trimester BMIs (Table 1). The effect of maternal BMI on the pregnancy outcomes was studied in all these BMI groups.

Table 1: Study groups.

Group	Category	BMI
1	Underweight	Less than 18.5
2	Normal weight	18.5- 22.9
3	Overweight	23-24.9
4	Obese 1	25-29.9
5	Obese 2	More than 30

Statistical analysis

Maintain data confidentiality, Statistical analysis was carried out with the help of Micro soft Excel and Epiinfo 7.1 software. The description of the data was done in form of arithmetic mean±SD (or median) for quantitative data while in the form of frequencies (%) for qualitative (categorical) data, p values of <0.05 were considered significant. For comparison of categorical variables (i.e., to examine the associations between qualitative/ quantitative variables), Chi-square test/t test was used, if the number of elements in each cell were 5 or higher and Fisher's exact test, otherwise.

RESULTS

In our study we noticed majority of the study subjects (52.35%) were in the range 21-25 years, 28.23% subjects were in the range 26-30 years, 15.29% subjects were in the age group ≤20 years whereas only 0.59% study subjects were in the age group ≥36 years.

Table 2: Distribution of study population as per BMI status (n=170).

BMI	N	%
Normal	93	54.7
Obese I	39	22.9
Obese II	11	6.5
Overweight	08	4.7
Underweight	19	11.2

Mean age was 24.12. Majority (52.4% study subjects) belonged to socioeconomic class (SEC) V. 33.5% subjects were in the SEC IV, 12.4% study subjects were in the SEC III, whereas only 1.8% study subjects were in the SEC II

class. 43.53% subjects were primigravida, 37.06% subjects had gravida 2, 14.12% subjects were gravida 3, whereas 5.29% subjects were gravida 4. The (Table 2) shows distribution of study population as per BMI status.

We tried to find the association between weight gain during pregnancy & BMI status, (Table 3) shows the association is significant. Average mean weight gain in our study was 9.1118 kg.

Table 3: Associations between BMI status and weight gain during pregnancy (ANOVA test applied, p<0.001-significant) (n=170).

BMI category	Mean (kg)	N	SD	Minimum (kg)	Maximum (kg)
Normal	9.0968	93	1.76355	5.00	13.00
Obese I	8.5641	39	1.23106	6.00	11.00
Obese II	7.3636	11	0.92442	6.00	09.00
Overweight	8.7500	08	1.28174	7.00	11.00
Underweight	11.4737	19	1.26352	9.00	14.00

Table 4: Association of gestational diabetes mellitus, pre-eclampsia, oligohydramnios, preterm premature rupture of membrane and presentation of foetus with BMI status (n=170).

BMI category		Normal (N=93)	Obese I (N=39)	Obese II (N=11)	Overweight (N=8)	Underweight (N=19)	Total mother
GDM	Developed and treated with insulin	0	5	5	0	0	10
	Developed and treated with medical nutrition therapy (dietary modification)	2	4	3	1	0	10
	No GDM	91	30	3	7	19	150
Chi-square value- 59.74, p value less than 0.00001, significant							
PE	No PE	90	25	04	06	17	142
	Mild PE	03	12	04	0	02	21
	Severe PE	0	02	03	02	0	07
Chi-square value-57.45, p value less than 0.00001, significant							
Liquor volume	Normal	87	30	08	06	19	150
	Oligohydramnios	02	04	02	02	0	10
	Polyhydramnios	04	05	01	0	0	10
Chi-square value-19.37, p value-0.01, significant							
PPROM	Developed	01	02	03	01	0	07
	Not developed	92	37	08	07	19	163
Chi-square value-19.46, p value-0.01, significant							
Presentation of foetus	Breech	02	07	03	02	02	16
	Transverse	01	01	0	0	0	02
	Cephalic	90	31	08	06	17	152
Chi-square value-16.66, p value-0.03, significant							

We found significant association between BMI status and development of gestational diabetes mellitus (GDM), pre-eclampsia (PE), oligohydramnios, preterm premature rupture of membrane (PPROM) & presentation of foetus as shown in (Table 4). We found only 2 mothers having placenta previa out of 170, one from obese I group and another from obese II group.

On applying chi-square (Chi-square value-8.00) it was found statistically non-significant with p value 0.092. Significant association was found between BMI status and mode of delivery, incidence of post-partum haemorrhage (PPH), post-partum wound infection as shown in (Table 5). The mean hospital stays in obese II group were 5.91±2.07 day, in obese I group 7.00±3.27 days, in underweight 5.05±1.81 day, overweight6.38±1 days whereas in normal body weight study subject hospital stay was 3.25±2.04 day. On applying ANOVA test we found significant difference (p≤0.001). Regarding preterm birth, development of foetal growth restriction (FGR), meconium aspiration syndrome (MAS), we found significant association with BMI status. But no association found with first minute APGAR score (Table 6).

DISCUSSION

In our study, majority of the study subjects (52.35%) were in the range 21-25 years with mean age of 24.12. Though

advanced maternal age is associated with increased risk for obesity, but some studies showed no association between maternal BMI and age; however, our study did not prove this association.

Table 5: Association of mode of delivery, incidence of post-partum haemorrhage, post-partum wound infection with BMI status (n=170).

BMI category		Normal (N=93)	Obese I (N=39)	Obese II (N=11)	Overweight (N=8)	Underweight (N=19)	Total mother
Mode of delivery	Caesarean section	11	27	03	03	07	40
	Instrumental delivery	05	04	04	01	01	15
	Normal vaginal delivery	77	08	04	04	11	104
Chi-square value-60.86, p value less than 0.00001, significant							
PPH	Developed	01	01	02	0	0	04
	Not developed	92	38	09	08	19	166
Chi-square value-13.31, p value-0.01, significant							
Post partum wound infection	Developed	03	09	01	0	0	13
	Not developed	90	30	10	08	19	157
Chi-square value-17.99, p value-0.001, significant							

Table 6: Association of preterm birth, development of foetal growth restriction, meconium aspiration syndrome, first minute APGAR score with BMI status (n=170).

BMI category		Normal (N=93)	Obese I (N=39)	Obese II (N=11)	Overweight (N=8)	Underweight (N=19)	Total mother
Preterm birth	Yes	01	02	03	01	0	07
	No	92	37	08	07	19	163
Chi-square value-19.46, p value-0.01, significant							
FGR	Yes	02	02	03	0	06	13
	No	91	37	08	08	13	157
Chi-square value-26.4, p value less than 0.00001, significant							
MAS	Absent	93	36	10	08	19	166
	Present	0	03	01	0	0	04
Chi-square value-9.90, p value-0.04, significant							
APGAR score (1 minute)	7 or less than 7	12	07	04	01	04	28
	More than 7	81	32	07	07	15	142
Chi-square value-4.47, p value-0.34, non-significant							

Relatively lower age in pregnancy in our study (15.29% subjects were in the age group ≤20 year) may be the factor as our study area being socioeconomically backwards (Majority, 52.4% study subjects belonged to socioeconomic class V) and early marriage and early pregnancy are accepted norms. In our study 54.7% mothers were in the normal BMI range, 22.9% were in the obese I group, 11.2% were underweight, 6.5% were obese II, 4.7% were overweight which is in contrary to study done by Eltayeb et al in Sudan in 2021.[2] The lower socioeconomic condition of the study area may explain the significant percentage (11.2%) of underweight mother in our study population. We found mean weight gain is maximum in underweight BMI group mother (mean 11.47 kg) followed by normal BMI group and obese group which is lower than underweight group mothers. This observation is similar to study done by Çalik et al at Turkey in 2014.[3] But in our study the overall mean weight gain was 9.11 kg which was lower than this study. Difference in county's atmosphere, health facility and gross socioeconomic condition may be the reason behind this difference. In the present study 9 mothers from obese I group (23%), 8 mothers from obese II group (72.7%), 1 mother from overweight group (12.5%) and 2 mothers from normal BMI group (2%) developed GDM. No mother developed GDM from underweight group. Higher incidence of GDM in obese, overweight women in our study is similar to the finding of study done by Yong in 2020.[4] Inflammation and insulin resistance in obese, overweight women may be the cause.[5,6] We observed significant association of preeclampsia (PE), caesarean section (CS), pre-term labour, post-partum haemorrhage (PPH), post-partum wound infection with obese & overweight mother which is similar to the study done by Yazdani et al at two hospitals of Babol city in Iran in 2008-2009 as well as the study done by Sohinee Bhattacharya et al in 2007.[7,8] Among obese and

overweight group 39% mothers developed PE, 5.1% mothers developed PPH, 56.8% mothers underwent CS, 15.5% mothers underwent instrumental delivery, 10.3% mothers had pre term delivery, 17% mothers developed post-partum wound infection. Obesity leads to GDM & diabetic mothers are prone to wound infection. GDM is also the cause of macrocosmic baby leading to prolonged labour, shoulder dystocia and increased rate of caesarean section and post-partum haemorrhage. Interestingly underweight mothers are not significantly associated with these outcomes in our study. Significant association for FGR and MAS with maternal BMI was found in our study, similar to study result done by Radulescu et al.[9] 2 mothers out of 39 in group I (5%), 3 out of 11 in group II (27%) and 6 out of 13 underweight mother (46%) group developed FGR in our study. Complex maternal metabolic environment on developing foetus in obese mother alone or complicated by PIH or GDM may be the cause. In underweight mother, malnutrition and micronutrient deficiency may lead to development of FGR. We found no significant association between low APGAR score and maternal BMI in our study.

Limitations

Limitations were; As the study was retrospective observational in nature, so collected data was the only resource. Difference of the severity of the complications or outcomes could not be examined. Confounding factors like pre pregnancy BMI, dietary habit/modification during pregnancy was not taken into consideration. Other obstetric indications of caesarean section (CS) were not taken into consideration, so CS may not be suitable adverse outcome.

CONCLUSION

In this study, we found significant correlation between adverse pregnancy outcomes and overweight/obese mothers. These outcomes are not significantly associated with underweight mothers and mother with normal BMI, except foetal growth restriction which is significantly found to be associated with underweight mothers. So, pre conceptional normal BMI is essential for every woman willing to conceive. This can reduce lots of adverse pregnancy outcomes. Nutrition-specific interventions from private as well as public sectors are required for developing countries to prevent altered pre pregnancy BMI. Nutrition-sensitive programs like food security, poverty alleviation, women education, women empowerment and dietary consultation for all newly married couples may be the initiatives for these interventions.

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